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Growth Retardants for Control of Ground Covers

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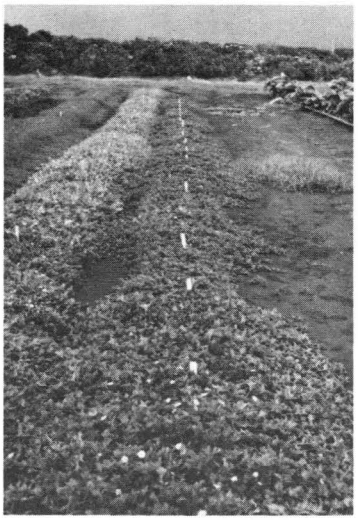

A Five-foot portions of narrow rows of ground cover were sprayed with retardant. After 6 weeks, the width of the row was recorded as a measure of the effectiveness of the treatment. The constricted zone of wedelia shows the effectiveness of chlorflurenol.

B Chlormequat was most effective in the field, with the least amount of injury noted on the plants. The chlormequat-retarded growth of asystasia is on the right; the control growth without retardation is on the left.

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Table 1. Growth retardants screened, 1972-1974

Trade name or code name	Common name or abbreviation	Chemical name
Arest	ancymidol	α-cyclopropyl-α-(4-methoxyphenyl)-5-pyrimidine methanol
Cycocel	chlormequat	(2-chloroethyl)trimethylammonium chloride
Maintain CF 125	chlorflurenol	methyl 2-chloro-9-hydroxyfluorene-9-carboxylate
RH 531	CCDP	sodium 1-(p-chlorophenyl)-1,2-dihydro-4,6-dimethyl-2-oxonicotinate
B-nine, Alar	daminozide (SADH)	succinic acid-2,2-dimethylhydrazide
Sustar 2-S	fluoridamid	[N-4-methyl-3-[[(1,1,1-trifluoromethyl) sulfonyl]amino]phenyl]acetamide
MH-30	maleic hydrazide	diethanolamine salt of 6-hydroxy-3(2H)pyridazinone

Table 2. Retardants used in field trials on ground covers based on greenhouse responses

Plant material	Retardant[a]				
	Ancymidol	Chlormequat	Chlorflurenol	CCDP	Daminozide
Arctotheca calendula	X	X			X
Asystasia gangetica	X	X		X	
Dissotis plumosa	X	X		X	
Gazania uniflora leucoleana	X	X		X	X
Osteospermum fruticosum		X			X
Phyla nodiflora	X			X	X
Wedelia trilobata	X		X	X	

[a]Fluoridamid became available after the greenhouse trials had been run; maleic hydrazide is a growth inhibitor and not a retardant.

Table 3. Arctotheca calendula growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field III
ancymidol	100	48.0	70.8		
	200	31.0	75.0		
daminozide	2500	44.5	95.5		
	5000	40.6	81.7	8	89.5
chlormequat	1500	40.6			
	3000	47.0	76.2	4	92.0
CCDP	1250	85.0	75.0	2	63.0
	2500	91.5	63.2	4	72.5
maleic hydrazide	5000	30.4			
chlorflurenol	600	dead		¼	29.5
fluoridamid				1	75.0
				2	70.5

Growth Retardants for Control of Ground Covers

Richard A. Criley

Hawaii's favorable year-round climate allows continuous growth of many landscape ornamentals. Some, such as ground covers, quickly grow out-of-bounds and require cutting back, for which, in many cases, time-consuming and expensive hand labor is employed. The high costs of maintenance of vigorous ground covers and the frequency of cutback may be reduced through the use of chemical growth retardants (2).

Seven such growth retardants (Table 1) were screened on seven container-grown ground covers widely used in tropical landscapes (1). Three field trials were established, based on the greenhouse responses of these plants (Table 2).

Single rows 120 feet long of each ground cover were planted at the Waimanalo Research Center, Island of Oahu, Hawaii. After establishment, they were cut back with an edger to a uniform width. The row was divided into three subunits, which served as the replication blocks. Five-foot sections of ground cover were sprayed with the growth retardant solutions. After six weeks, the widths of these sections were taken and the increase in area over the initial area was calculated. On a few plants, height measurements were also taken. The experiment was repeated twice at different times of the year after the effects of the previous treatment had worn off. In the later trials, a foaming agent was included at 1 fluid ounce per gallon.

In the first experiment (Field I), the same spray concentrations were used as had proved effective in the greenhouse. After calculating how much active ingredient was actually applied in this experiment, conversions to pounds, or fractions of a pound, per acre were made for the next two experiments (Fields II and III). In general, this conversion represented a slight increase over the greenhouse concentration. Tables 3 through 9 show the concentration expressed as parts per million (ppm) and pounds per acre (lb/acre).

In Tables 3 through 9, growth reductions to 80 percent or less of the control are considered significant. There was sufficient variation in the field to be cautious about interpreting data that did not differ by more than 20 percent.

Arctotheca calendula (Table 3).

Also called Cape carpet or beachweed, arctotheca is a prostrate ground cover that roots at each node, providing excellent resistance to erosion. It spreads very quickly when provided adequate moisture, but it also survives dry conditions well. In greenhouse trials, ancymidol, daminozide (SADH), and chlormequat provided some retardation, while chlorflurenol killed the plants. In the field, there was no effect of daminozide and a slight effect of chlormequat, but a marked effect of chlorflurenol and CCDP to 29 and 63 percent of the control, respectively. The effect of chlorflurenol persisted for almost 10 weeks.

Asystasia gangetica (Table 4).

Also called coromandel, asystasia is a vigorous herb that will climb supports and mound to a depth of a foot or more if given adequate moisture. It is widely used along banks and roadside cuts. Most of the treatments in the greenhouse reduced growth, and chlorflurenol caused injury; in the field, the most effective material--one that did not cause injury--was chlormequat at 80 and 47 percent of control. The effect persisted up to 12 weeks after treatment. Chlorflurenol was even more effective with only 16.7 and 34.6 percent of control growth, but there was some distortion. The effect of chlorflurenol persisted longer than 12 weeks, but observations ceased then, and the plants were cut back.

Table 4. Asystasia gangetica growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field II	Field III
ancymidol	100	126.0	99.0	¼	97.0	
	200	52.3	106.0	½	91.0	
daminozide	2500	41.5				
	5000	88.5	106.8	8	88.0	69.5
chlormequat	1500	74.5				
	3000	50.5	79.6	4	87.5	47.3
CCDP	1250	136.5	96.3	2	91.0	77.8
	2500	67.5	98.5	4	91.5	75.0
maleic hydrazide	5000	36.6				
chlorflurenol	600	16.8		¼	34.6	16.7
fluoridamid				1	103.0	
				2		80.6

Dissotis plumosa (Table 5).

Dissotis is an herbaceous plant in the Melastomaceae family. Even though it tolerates full sun, it seems to grow better in partial shade. Ancymidol was most effective in the greenhouse and showed some effect in the field; the chlormequat field treatments caused slight chlorosis but also did a good job of retardation (Figure 1). Fluoridamid, a turf retardant, also reduced the rate of growth.

Table 5. Dissotis plumosa growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field II	Field III
ancymidol	100	9.5	37.4	¼	102.5	
	200	3.8	37.4	½	108.0	
daminozide	2500	40.0				
	5000	60.0	53.0	8	92.0	60.6
chlormequat	1500	63.4	40.5	2	86.0	60.6
	3000	62.7	37.4	4	87.8	50.0
CCDP	1250	40.8	57.0	2	102.1	82.0
	2500	42.6	32.9	4	102.5	57.2
maleic hydrazide	5000	49.8				
chlorflurenol	600	9.9				
fluoridamid				1	101.0	39.3
				2		21.4

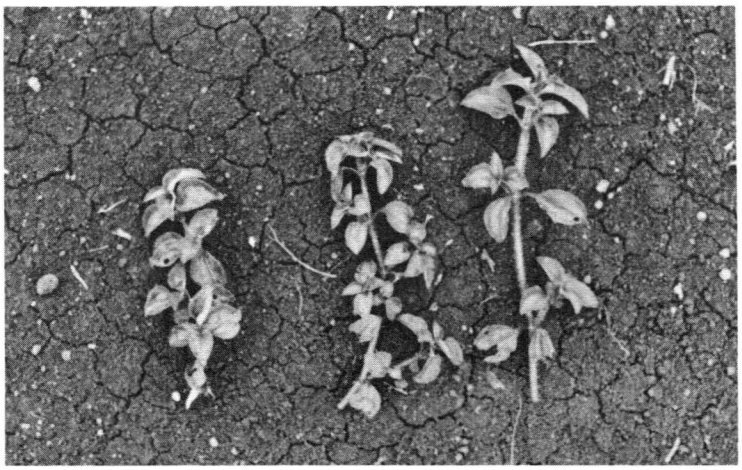

Figure 1. Dissotis: chlormequat-retarded growth (left); ancymidol-treated growth (center); control (right).

Gazania uniflora leucoleana (Table 6).

Also called trailing gazania, gazania has attractive silver-green foliage with golden-yellow flowers and seems to do best in dry conditions. Both ancymidol and daminozide were effective in the greenhouse, but ancymidol was not as effective in the field. The experimental material, CCDP, also provided some retardation as did fluoridamid, but the data should be interpreted cautiously since overwatering hampered active growth of the gazania in the last field trial. In general, the retardants did not cause as great a reduction in growth for the gazania as they did for other ground covers.

Table 6. Gazania uniflora leucoleana growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field III
ancymidol	100	63.5	94.0		
	200	67.0	87.6		
daminozide	2500	61.4	101.8		
	5000	65.6	77.3	8	84.2
chlormequat	1500	105.2			
	3000	76.8		4	79.0
CCDP	1250	52.6	100.0	2	-52.7[a]
	2500	52.0	83.7	4	42.1
maleic hydrazide	5000	86.0			
chlorflurenol	600	23.3			
fluoridamid				1	52.7
				2	-42.1[a]

[a]The designation - preceding some data show treatments in which there was dieback from the original starting width over the 6-week growth period.

Osteospermum fruticosum (Table 7).

Also called trailing African daisy, osteospermum has vigorous stems with thick, dark-green leaves and white flowers; it is a ground cover widely used in southern California along freeways. In Hawaii it grows well at higher elevations, and a purple-flowered form is also

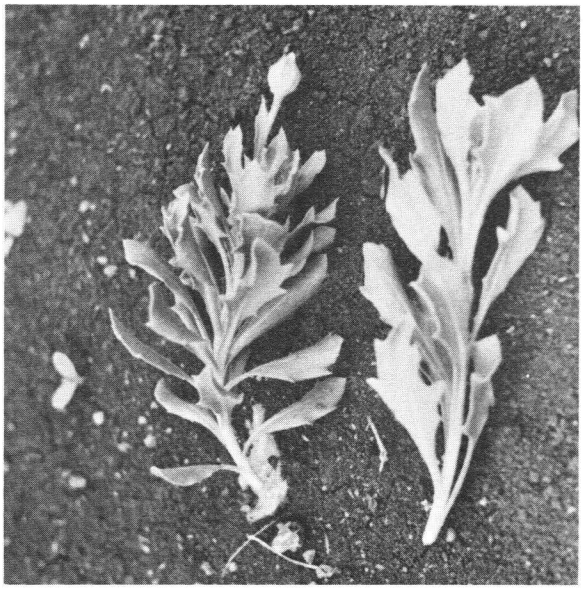

Figure 2. Osteospermum: chlormequat-treated growth (left) shows shortened internodes and darker green foliage; control (right).

available. Both chlormequat (Figure 2) and CCDP retarded growth in the greenhouse and field, while ancymidol and daminozide were less effective. Chlorflurenol caused undesirable distortion in the greenhouse, but the planting was visually acceptable after treatment in the field. Fluoridamid also showed some promise.

Table 7. Osteospermum fruticosum growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field III
ancymidol	100	86.5	89.1		
	200	68.0	92.1		
daminozide	2500	80.5			
	5000	93.7	87.8		
chlormequat	1500	37.1	73.0	2	64.6
	3000	42.5	48.3	4	29.4
CCDP	1250	62.2	78.8	2	82.3
	2500	39.3	91.5	4	82.3
maleic hydrazide	5000	64.0			
chlorflurenol	600	38.1		¼	53.0
fluoridamid				1	58.8
				2	70.5

Phyla nodiflora or Lippia canescens (Table 8).

Phyla is a tiny-leafed ground cover that is extremely vigorous. In the greenhouse trials, ancymidol sprays drastically changed its appearance to something almost bonsai-like. Ancymidol had very little effect at the same rate in the field. Chlorflurenol and the higher rate of fluoridamid both reduced growth through phytotoxicity. However, CCDP did cause reduction to 77 percent of the control and the lower rate of fluoridamid to 50 percent of the control. The only persistent effect was that of chlorflurenol, since normal elongation was evident at 6 weeks for all the other materials.

Table 8. Phyla nodiflora growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field III
ancymidol	100	8.2	82.8		
	200	9.3	83.5	½	120.0
daminozide	2500	53.5	83.5		
	5000	22.9	76.1	8	150.0
chlormequat	1500	50.0			
	3000	34.8			
CCDP	1250	78.3	86.7	2	70.0
	2500	64.5	76.1	4	130.0
maleic hydrazide	5000	34.7			
chlorflurenol	600	10.9	26.0	¼	-70.0[a]
fluoridamid				1	50.0
				2	-70.0[a]

[a]The designation - preceding some data show treatments in which there was dieback from the original starting width over the 6-week growth period.

Wedelia trilobata (Table 9).

Wedelia is widely planted as a ground cover on banks and roadcuts, in planters, along sidewalks, and wherever ground covers can be used. It tolerates shade and does best in full sun. Because of its widespread use, it poses the major maintenance problem. Little or no retardation was observed on potted wedelia in the greenhouse with daminozide, chlormequat, and ancymidol, and none of these were very effective in the field. The most effective material was chlorflurenol, although it did cause some distortion of growth (Figure 3). In the field, it was effective for at least 12 weeks. Shortening of the internodes and a modification of the lobes of the leaves characterized the retardation conferred by CCDP. The visual effect of CCDP on wedelia was more pleasing than that of chlorflurenol, although the effect was less persistent.

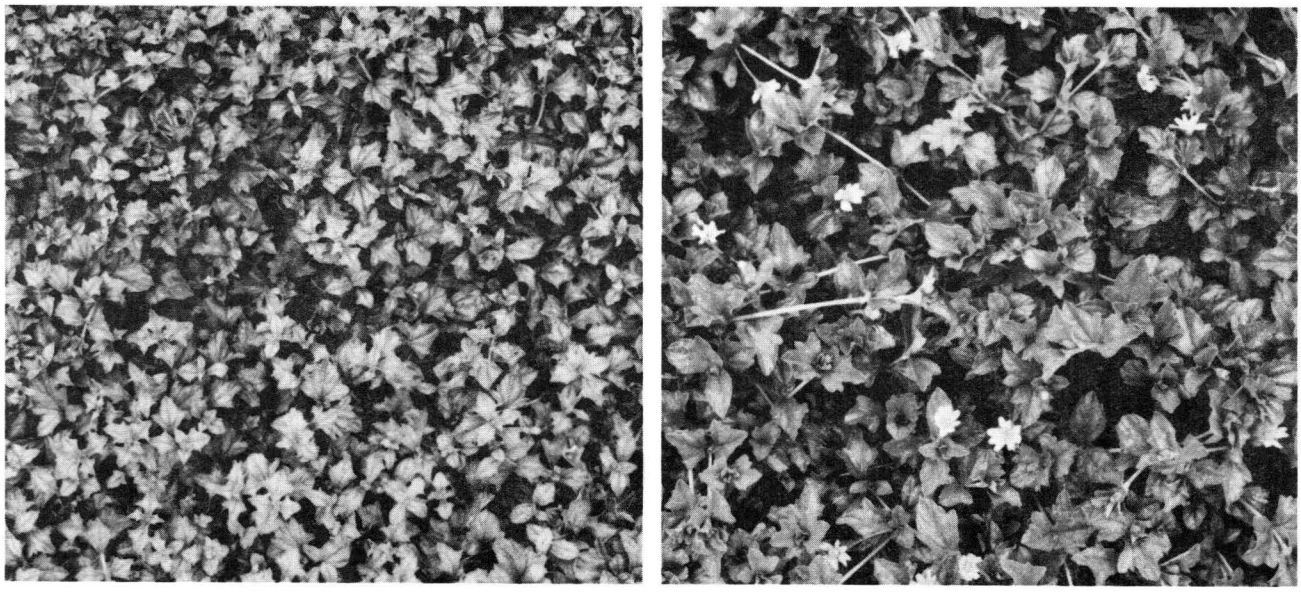

Figure 3. Wedelia: chlorflurenol-treated growth (left) suppressed flowering; control (right).

Table 9. Wedelia trilobata growth as a percent of the control

Retardant	Concentration (ppm)	Greenhouse	Field I	Concentration (lb/acre)	Field IIa[a]	IIb[a]
ancymidol	100	111.2	84.5	¼	91.4	
	200	81.0	90.5	½	91.7	98.5
daminozide	2500	67.8				
	5000	112.9				
chlormequat	1500	92.5				
	3000	90.6				
CCDP	1250	83.5	86.5	2	92.0	91.7
	2500	79.5	71.7	4	88.8	95.0
maleic hydrazide	5000	63.8				
chlorflurenol	600	30.7	23.5	½	54.0	75.0
	900		27.5	3/4	48.0	71.0

[a]Measurements of the same field were taken at 6 weeks (IIa) and 10 weeks (IIb).

Of the various retardants applied in the field, daminozide and ancymidol were effective on the fewest plants. Chlormequat retarded growth on asystasia, dissotis, and osteospermum. CCDP caused retardation on gazania, wedelia, dissotis, arctotheca, and phyla. Chlorflurenol was effective on everything, but only coarse ground covers--such as wedelia, osteospermum, and asystasia--would benefit. Fluoridamid received but one field trial and showed promise on all ground covers. On wedelia the higher concentration of 8000 ppm fluoridamid proved satisfactory in later studies. Maleic hydrazide was tested in the greenhouse only; it was considered a growth inhibitor and not applied in the field retardation trials, although it, too, should be effective in reducing growth.

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1. Criley, R. A. 1972. Screening growth retardants for control of rapid-growing ground covers. American Nurseryman 136 (10):70-73.

2. Elkin, D. M. 1974. Controlling growth with chemical retardants. Grounds Maintenance 9(3):40, 42, 44, 46.

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